International Labour Office Geneva

Proposals for the statistical definition and measurement of green jobs[1]

Discussion paper prepared for informal consultation, November 2012

Valentina Stoevska and David Hunter

Department of Statistics

International Labour Office

[1] This Report was prepared by David Hunter and Valentina Stoevska with support from Mercedes Duran and Sanaz Ettehad. The views expressed are those of the authors and do not necessarily reflect those of the ILO or its Department of Statistics. The authors would welcome comments and suggestions for improvement and correction. Address: CH-1211 GENEVE 22, Switzerland; e-mail: hunter@ilo.org; stoevska@ilo.org.

Prepared without formal editing

Abbreviations

BLS	Bureau of Labor Statistics, United States Department of Labor
CEA	Classification of Environmental Activities
CPC	Central Product Classification
EGSS	Environmental Goods and Services Sector
GGS	Green Goods and Services
ICLS	International Conference of Labour Statisticians
IEO	International Employers Organization (IEO)
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification of All Economic Activities
ITUC	International Trade Union Confederation
LFS	Labour Force Survey
NACE	Statistical Classification of Economic Activities in the European Union
NAICS	North American Industrial Classification System
OECD	Organisation for Economic Co-operation and Development
SAMs	Social Accounting Matrices
SEEA	System of Environmental-Economic Accounting
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme

Table of Contents

1 Introduction

1. Over the past few years, the international community has emphasized the implications of climate change for economic and social development, for production and consumption patterns and therefore for employment, incomes and poverty. Many have stressed the importance of shifting towards a green and sustainable economy.

2. The concept of the green economy has thus become a focus of policy debate and has been mainstreamed into the work of the United Nations and its specialized agencies. Much of the discussion has focused on the potential of the green economy to provide significant opportunities for investment, growth, and jobs. This has led to an increasing need for the statistical community to deal with the difficult task of defining and measuring the concept of "green jobs" in order to produce internationally harmonized statistics that would inform the ongoing policy debate on the economic and employment impact of "greening" the economy.

3. Measurement of the production and employment of the green sector of the economy has also been strongly requested by policy departments and businesses which need reliable internationally harmonized statistics on green jobs to assist in (i) gaining a better understanding of the impact of "greening the economy" on the labour market, and (ii) ensuring that effective policy measures and tools are formulated to respond to this shift to a greener economy. The ILO, in particular, has seen a growing demand for both statistical data and for conceptual guidelines on the measurement of green jobs.

4. The demand for statistics on green jobs is increasing in step with the challenges of managing the environment. Climate change, biodiversity loss and the demand for natural resources are among a growing list of environmental issues about which decisions need to be made.

5. The United Nations Conference on Sustainable Development (Rio+20 Conference), held in Rio de Janeiro in June 2012, considered that the green economy was an important pathway to sustainable development. According to the outcome document of the conference, *The future we want* [2], the Rio+20 Conference:

   - considers green economy as one of the important tools available for achieving sustainable development (paragraph 56);
   - invites governments to improve knowledge and statistical capacity on job trends, developments and constraints and integrate relevant data into national statistics, with the support of relevant United Nations agencies within their mandates (paragraph 62);
   - invites the United Nations system, in cooperation with relevant donors and international organizations, to coordinate and provide information methodologies for evaluation of policies on green economy in the context of sustainable development and poverty eradication (paragraph 66);

[2] The Future We Want - Outcome document of the United Nations Conference on Sustainable Development available at http://www.uncsd2012.org/futurewewant.html#IIIc

- promotes access to reliable, relevant and timely data in areas related to the three dimensions of sustainable development (paragraph 76).

6. The need to develop a response to this demand for the comprehensive collection, organization and analysis of data on green jobs (in terms of the size, composition and contribution of the specific groups of workers and economic units to the green economy) that would enrich existing labour market information at international and country levels, represents a significant challenge for the statistical community. It underlines the importance of developing a standard conceptual framework along with appropriate operational definitions and measurement methods that will facilitate the development and production of harmonised and comparable data. The ILO has already tried to measure the number of green jobs in various countries. From this exercise it became clear that the concept is extremely complex and that practical measurement aspects should not be neglected.

7. In October 2013, the ILO will host the 19th International Conference of Labour Statisticians (ICLS). This offers the opportunity to promote discussion of the issues amongst the international statistical community and to seek advice on proposals for a statistical definition of green jobs, guidelines for statistical measurement, as well as future steps in developing relevant international statistical standards. To achieve this, the ILO plans to present a concept paper that will review current practice in selected countries, and suggest a standardized definition that could be applied by countries in all regions and at all stages of economic and social development. This paper will need to draw on other international statistical work in related fields, such as environmental accounts and energy statistics and discuss methodological issues, potential data sources and further work needed to reach agreement on an international statistical standard.

8. The purpose of the present paper is to expose preliminary ILO thinking on the conceptual and measurement framework for defining and identifying green jobs, including on the international definition of green jobs for statistical purposes. In its current form it may be seen as a draft of the paper that will be discussed at the ICLS. It is likely to require further expansion in a number of areas. We hope to receive comments from others working on environmental and labour market statistics and policy that will assist in further developing the proposals. The final aim is to agree on a definition of "green jobs" which could provide a basis for any method of data collection, reference period or time unit and that could refer to all workers. Reaching consensus on the definition of green jobs would, in turn, facilitate the development and production of harmonized and comparable data.

Structure of the Report

9. The paper is organized as follows.

   - Chapters 1 and 2 provide general background information and describe the policy context that is driving the demand for statistics on green jobs and the green economy more generally, giving some examples of recent national and international developments.

   - Chapter 3 discusses the objectives , and potential uses of statistics on green jobs;

- Chapter 4 discusses existing practices in defining green jobs;
- Chapter 5 proposes definitions of concepts for the statistical measurement of green jobs
- Chapter 6 discusses issues and problems in the statistical measurement of green jobs, and proposes possible methods of measurement
- Chapter 7 discusses data collection issues and possible sources of data;
- Chapter 8 suggests the types of data and indicators that could be produced.

10. An overview of existing concepts and definitions related to the green economy is included as Appendix 1. In Appendix II we include descriptions of national practices in defining and measuring green jobs in selected countries. In Appendix III we present existing data on a range of economic variables and the number of jobs in the Environmental Goods and Services Sector in selected countries.

2 Policy context

11. Although the concept of sustainable development was defined in 1987 report "Our Common Future" prepared by the United Nations Brundtland Commission, the concepts of the green economy and green jobs are relatively new. The notion of green jobs has gained importance over the last couple of years to a large extent because it is seen by many to provide a response to the multiple crises that the world has been facing in recent years – the climate, food, financial and economic crises. It is seen as an alternative paradigm that offers the promise of economic growth and job creation while protecting the earth's ecosystems and, in turn, contributing to poverty alleviation

12. There is no globally accepted definition of the green economy, but the term emphasizes the crucial point that economic growth and environmental sustainability complement each other. It refers to the way in which natural resources are used to produce goods and services for the population. It involves a new form of production and a new way of relating to our environment. The term "green jobs" tends to be used to describe people working in ecologically sustainable or environmentally beneficial jobs.

13. Another factor that should be taken into account is that, although initially limited to climate change and reduction of carbon emissions, the green economy concept has evolved in recent years and expanded to cover the investments and actions necessary to respond to all environmental management challenges. In other words, the idea of the green economy is no longer limited to climate change and reduction of carbon emissions. Moreover, the concept of the green economy has evolved from seeking to achieve short-term green economic growth into strategically transforming economic development paradigms in order to achieve both long-term sustainable development and the promotion of decent work. This includes the greening of the entire economy.

14. The ILO has had a long-standing involvement with sustainable development and with environmental issues related to the world of work. This has included active participation in the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, in the World Summit on Sustainable Development, held in Johannesburg in 2002, and in the United Nations Conference on Sustainable Development, held in Rio de Janeiro in June 2012.

15. In 2007 the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), and the International Trade Union Confederation (ITUC) jointly launched the Green Jobs Initiative. The International Employers Organization (IEO) joined the Initiative in 2008. This initiative was launched as one of a number of initiatives aimed at addressing multiple and interrelated global crises which are having an impact on the international community, namely the financial crisis, the food crisis and the climate crisis.

16. One of the objectives of the Green Jobs Initiative was to *assess, analyse and promote the creation of decent jobs* as a consequence of the policies needed to address the global environmental challenges, among others, climate change. The main outputs of the initiative are the reports *Green Jobs: Towards Decent Work in a*

Sustainable, Low-Carbon World[3] (Sept.2008), and *Working towards sustainable development: Opportunities for decent work and social inclusion in a green economy*[4] **(**June 2012).

17. *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* was the first comprehensive report on the emergence of a "green economy" and its impact on the world of work in the 21st Century. It also presented a definition of the concept of green jobs for policy purposes.

18. The 2012 report *Working towards sustainable development: Opportunities for decent work and social inclusion in a green economy* argued that a green economy would create more and better jobs, lift people out of poverty and promote social inclusion if accompanied by the right policy mix. It also asserted that employment and social inclusion must be an integral part of any sustainable development strategy**.**

19. The report *Towards a Green Economy. Pathways to Sustainable Development and Poverty Eradication* **(**UNEP, 2011)[5], noted that green investments contribute to reducing environmental damage while boosting economic growth and creating jobs, thus achieving sustainable development for both developed and developing countries. This report also defined the concept of green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." In this connection, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive.

20. Numerous definitions of the green economy have been produced by different organizations. Various reports have also offered and introduced or referred to other related concepts such as green growth (Towards green growth, OECD 2011)[6], green-collar worker (How green is my occupation classification, New Zealand. 2010[7]), low carbon economy, a circular economy, greening economy, transition to greener economies, sustainable development, environmental development, green investments, green skills, green workplace, green labour market, etc. An overview of existing concepts and definitions related to green economy is provided in Appendix 1.

21. Some of these terms such as 'green', 'environmental' and 'sustainable' are often used interchangeably to describe companies, people or technologies that do 'greenish' things. They do not mean the same thing, however. Although these terms are not synonymous, all approaches do go in the same direction: showing a path towards a new economic model that is based on ecologically compatible use of resources and economic efficiency. Increasingly, the scope of a green economy is

---

[3] http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf

[4] http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_181836.pdf

[5] http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_synthesis_en.pdf

[6] http://www.oecd.org/greengrowth/48012345.pdf

[7] http://www.victoria.ac.nz/vms/industrial-relations-centre/irc-events/lew-conference-welcome/lew-papers/D5_LEW14_final_paper_-_Hancock.pdf

seen as going beyond the creation of environmental goods, services and jobs, since it includes broader dimensions of energy and resource efficiency, poverty eradication, social equity, and human well-being. Many of the approaches have the added dimension of promoting social justice and decent work. As there is no single, agreed definition of the green economy discussions are ongoing as to what might be its relation to sustainable development.

22. The relationships between these concepts and to other related concepts have not been clearly articulated. “Green” has become a shorthand term to describe the wide range of issues, processes, products and services that relate to sustainability and the environment. The debate on the green economy has focused on the need for ecological, economic and social development. On the other hand the debate on green growth, which is considered as a way to pursue economic growth and development while preventing environmental degradation, has tended to focus more strongly on questions of market regulation and the provision of economic incentives.

3 Objectives and uses of statistics on green jobs

General requirements and types of user

23. Statistics on green jobs may be of interest to a wide variety of users, including but not restricted to the general public, media and civil society, decision and policy makers concerned with policies on economic growth, job creation, environmental protection, climate change and sustainability, as well as analysts, experts and advisors, academia, training institutions, government officials and international agencies.

24. Different users need statistics on green jobs with different levels of aggregation and disaggregation, and with specific depths of information and description, depending on the purpose and nature of the analysis to be undertaken. Users may, in many cases, be in need of cross-cutting datasets of environmental statistics. In other cases they may only be interested in particular topics and themes pertaining to environmental statistics for specific sectoral analysis and policy making.

25. Most of the users are interested in the size of the contribution of the green economy to economic growth, especially to turnover, employment (number of people employed directly or indirectly, their skill levels and the specialist skills required) value added, investments, exports, etc. The size of the green economy in terms of the number of establishments, the number of employees and the total turnover of the green economy are of special interest.

26. The volume of employment in green jobs, however we might define them, is seen by many as an important indicator of overall progress towards a greener, more environmentally sustainable economy. This highlights the need for an internationally agreed definition of the concept, as well as for guidelines on measurement, in order to provide a sound basis for international comparison.

27. More specifically, statistics on "green jobs" may provide governments with a tool for monitoring the transition to a greener economy, for designing and evaluating environmental and labour market policies, and for assessing the extent to which the economy is responding to various public policies and initiatives. They may also help establishments to supervise their own transition, and identify areas where improvements may be made. For these purposes "green jobs", which include a wide and highly heterogeneous set of jobs, may need to be analysed separately by types of greenness, because each type of greenness may reflect a different underlying phenomenon which may require different measures to be directed towards different target groups.

28. Distinguishing between different types of green job is important, not only because of their diversity but also because of the different uses to which statistics on green jobs may be put. When the type of green job being analysed is related to the *functioning* of establishments (e.g., energy efficiency, recycling) the focus may be on particular types of technology and methods of production. In contrast, when the type of green job being analysed is related to the *outputs* of establishments (e.g., production of organic food), relevant characteristics of the outputs produced may be the most appropriate factors to be considered.

29. Statistics are needed to provide information on changes over time and in the transition to a low-carbon economy by providing information on economic growth in specific industrial activities and on the corresponding job creation or loss. For these purposes statistics on green jobs should be linked to statistics on environmental output and/or environmental expenditure.

30. Statistics are also needed, however, to inform the development of and evaluate the impact of specific policy initiatives aimed at promoting environmentally sustainable employment or at making industrial production more environmentally friendly and sustainable.

Specific policy questions for which statistics are required

31. It can be seen from the above discussion that statistics on green jobs need to be conceived in such a way that they will help to answer a number of questions on many different aspects of environmental, economic and labour market policy. Some of the specific policy questions for which information is needed are identified below.

Job creation and loss

- What is the net employment creation effect arising from a particular type of investment, climate change policy, or environmentally motivated economic stimulus?
- What is the overall impact of environmental and economic policies on the labour market?
- What is the potential for green employment growth?
- What is or will be the employment shifts across and within sectors? Which are the industries and types of workers that are negatively affected?

Changes in occupational and skills needs

- What are or will be the transitions in employment patterns across occupations? For which occupations will there be increasing demand, and for which occupations will demand decrease?
- What new occupations are being created and what existing occupations are becoming greener?
- What new skills need to be developed, and what are the consequences for education and training systems in order adapt to the development of new areas of growth and new technologies?
- Are there skills bottlenecks, and if so, in which sectors and occupations? What are the skills gaps? How many people need to be trained in what skills in the transition to a green economy?

Organizational restructuring

- How many establishments restructure their organization and production processes to use less energy, to reduce emissions, to use cleaner technologies and/or to produce green products and services?

- What are the consequences of such restructuring for workers?

Decent work

- Are newly created green jobs good and decent? Is the transition to the low carbon green economy socially just? Which groups are affected in a positive way, and which groups may be disadvantaged? Are newly created green jobs accessible to all?
- Do particular green initiatives have a negative impact on particular social groups, on food security for specific populations and on employment in existing environmentally sustainable economic activities?[8]

32. All of these requirements imply the need, not only for the general definition and measurement of total employment in green jobs, but also for more detailed information on employment classified by type of environmental activity, occupation and economic activity (industry).

Statistical monitoring of green jobs to inform the development and evaluation of public policy

33. It is not difficult to conclude from the foregoing that statistical monitoring of green jobs will be necessary to facilitate the adjustment of policy interventions in a wide range of areas. Such monitoring is needed in order to allow evaluation and adjustment of policies aimed at promoting the green economy and environmental sustainability, to reflect changing conditions during implementation, and to provide a basis for the development of improved strategies in subsequent periods. Moreover, together with appropriate reporting procedures, statistical monitoring will promote public interest and information on sustainable development.
34. Identification of green economic activities and measurement of employment in these activities may be used to support decision-making regarding those industries that may require appropriate support (subsidies, access to credit and perhaps some level of protection). Statistical monitoring may also allow assessment of the extent to which establishments restructure their organization and production processes. It is a necessary precondition for the assessment of how skills, education and training systems need to adapt to the development of the green economy.
35. Another important potential use of statistics on green jobs is the creation of labour market projections that take account of both anticipated green growth and contraction in less sustainable activities. Such projections could assist in minimizing risk and uncertainty for training providers and in enabling businesses and governments to plan and invest strategically in new opportunities to drive innovation. The resulting information would also be useful for evaluating policy initiatives and the labour market impact of activities related to protecting the environment and conserving natural resources.

8 See, for example, the discussion on the impact of increased production of bio-fuels on low-income women in rural areas in Tandon, Nidhi, First Casualties of the Green Economy – Risks and losses for low-income women, Development (2012) 55(3), 311-319.

36. Statistics on the size, employment and share in trade of the green economy could be used to measure the positive side-effects of environmental policies such as innovation take-up, market development or export growth. They could equally be used to measure and project less desirable side-effects such as potential job loss in traditional 'brown' industries and in the geographic regions where these industries are located.

4 Existing definitions and practices in measuring green jobs

Definitions of green jobs used in the employment and environment policy contexts

37. Whilst there has been a great deal of debate in the policy arena about the promotion and measurement of green jobs, there is not necessarily a shared understanding of the concept of green jobs. The meaning of the term is far from universally consistent. Many organizations have developed their own definitions.

38. Before considering what is to be understood by the concept of 'green job' it is useful to consider related terms, such as 'green economy' Although the exact definition of 'green' varies among organizations, there are more similarities than differences in what is considered to constitute a green economy. A common theme is the preservation or restoration of the environment. Most studies also attempt to identify products and services that meet one of several criteria for a green economy. Information about the range of existing definitions related to the green economy, green growth and green jobs is provided in Appendix 1.

39. For products and services, most definitions include:

    1. Environmentally friendly and enhancing products and services
    2. Renewable energy products and services
    3. Clean transportation and fuels
    4. Green buildings

40. Some definitions also include the processes by which these products and services are produced. These include:

    1. Energy efficient manufacturing, distribution, and construction
    2. Reduction of energy, materials, and water consumption through high efficiency strategies
    3. Switching from carbon to non-carbon components.

41. Various efforts have been made to define green jobs by focusing on environmental protection and or on sectors of the economy such as forestry and renewable energy. Some studies have focussed on looking at different occupations and how they contribute to the greening of the economy, or have made attempts to define green jobs in terms of specific occupational groups. Most, if not all, of these attempts have a number of limitations, in that they use definitions that are either too broad or are focused only on selected industries and/or occupations.

42. As a means of understanding the concept of green jobs that we should ideally measure in these statistics, a useful starting point is the definition that was agreed for the purposes of the joint ILO UNEP report: *Green Jobs: Towards Decent Work in a Sustainable Low Carbon World (2008).* According to this definition, green jobs are defined as:

"...work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity, reduce energy, materials, and water consumption through high efficiency strategies, de-carbonize the economy, and minimize or altogether avoid generation of all forms of waste and pollution."

43. Whilst this definition is reasonably comprehensive, it seems to exclude, perhaps not deliberately, the possibility that green jobs might exist in activities such as mining, quarrying, transport, construction and energy supply.

44. According to the ILO, green jobs also have to be decent jobs. This is reflected in the broader definition currently used by the ILO Green Jobs Programme:

"Jobs are green when they help reduce negative environmental impact ultimately leading to environmentally, economically and socially sustainable enterprises and economies. More precisely green jobs are decent jobs that:

- Reduce consumption of energy and raw materials
- Limit greenhouse gas emissions
- Minimize waste and pollution
- Protect and restore ecosystems" [9]

45. This definition is reasonably comprehensive and reflects the main policy goals and issues which statistics on green jobs may need to inform. The need to capture the decent work dimension as well as the environmental dimension is an important consideration.

National and international efforts to measure sustainable development and green jobs

46. The green economy and, in particular green jobs, remain something of a mystery from the statistical perspective since there is no clear statistical definition of the green economy and of green jobs. There are very few comprehensive data on green jobs, even at national level.

47. Statistical agencies around the world are thus under pressure to deal with the difficult tasks of defining and measuring the concept of "green jobs" and of producing both nationally relevant and internationally harmonized statistics that would inform the ongoing policy debate on the economic and employment impact of "greening" the economy. Measurement of the employment effects (both positive and negative) of the various policy interventions aimed at promoting a greener economy, as well as the employment effects of climate change and environmental degradation, is not a simple matter, however.

48. Agencies at both national and international levels have responded to this challenge to provide statistics on sustainable development and on the impact of human activity on the environment in a variety of ways. In the sphere of economic statistics, agencies have collaborated to develop a System of Environmental

9 http://www.ilo.org/empent/units/green-jobs-programme/lang--en/index.htm, extracted on 17 July 2012

Economic Accounts (SEEA), the most recent version of which was adopted by the UN Statistical Commission at its 43rd session in 2012. There are similar initiatives in the related field of energy statistics.

49. The SEEA provides a definition of environmental goods and services and defines the Environmental Goods and Services Sector (EGSS) as consisting of producers of all environmental goods and services. It states that "EGSS statistics provide indicators of the production of environmental goods, services and technologies; the contribution of this production within the economy as a whole; and the extent of related employment, investment and exports from the sector." It adds that "EGSS statistics also provide an information base to assess the potential for economic activity and employment to be based on environmentally friendly and more resource efficient activities, and to assess the extent to which the economy is responding to various public policies and initiatives that have this objective in mind,"[10] It does not, however, provide guidelines for the measurement of employment in the EGSS.

50. In 2009 the Conference of European Statisticians established the UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development. In its report[11], this Task Force has proposed a conceptual framework for statistics and indicators of sustainable development. This framework includes dimensions for human well-being, capital, and 'transboundary' impacts. There are sub-dimensions for economic, natural, human and social capital, which provide linkages between economic, social and environmental elements. A number of indicators related to labour, such as the employment rate, are included within this framework. The labour related indicators included, however, do not allow for the separate identification of employment in environmentally sustainable or 'green' jobs.

51. Several national agencies in different countries have made efforts to estimate the number of persons employed in green jobs, defined in a variety of different ways and using a variety of methods of estimation. The earliest of these efforts involve the production of estimates of employment in environmental protection activities based on currently available data sources, with estimates tending to vary each year depending on the data available. Some national estimates are included in Appendix III.

52. Increasingly, national statistical offices at least in statistically developed countries, are producing estimates of green jobs or 'environmental employment', drawing on data from official establishment surveys. In these cases, data on either the kind of economic activity or on the goods and services produced are used together with data on total employment in each establishment to produce a total estimate of employment in green jobs. Data are released classified either according to kind of economic activity or according to 'environmental domains' such as 'waste management' or 'renewable energy' as defined in the SEEA. Estimates tend not be comparable between countries, however, due to differences in estimation methods and the definitions of green jobs used.

[10] SEEA White cover version, page 102

[11] The report is in draft form at the time of writing and is to be distributed in final form to all CES members in 'Spring 2013.

53. One of the most comprehensive approaches has been adopted by the US Bureau of Labor Statistics (BLS) which defines green jobs as either:

    (a) Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources (outputs), or

    (b) Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources (processes).

54. The use of these two overlapping elements to define green jobs implies two different approaches to statistical measurement: an output approach and a process approach. The definition goes on to define precisely which goods, services or processes are to be considered. [12]

55. To implement the output approach, BLS collected data on jobs associated with producing green goods and services through a mail survey of a sample of establishments identified as potentially producing such products and services. The purpose of the Green Goods and Services (GGS) survey was to identify whether the establishment is actually producing any green goods and services and, if so, to measure the number of associated jobs in the establishment. The results of this survey were released in March 2012, and indicated that in 2010 3.1 million jobs in the United States were associated with the production of green goods and services, representing 2.4 per cent of total employment.[13]

56. The methodology used by BLS in the GGS survey estimated the number of green jobs for selected industries based on the green jobs found at individual establishments classified within the industry. The methodology does not simply designate an industry as "green" and count all jobs in that industry as green jobs, since establishments in the industry may also produce goods and services that are not considered green.

57. For the process approach, BLS developed a special survey, the Green Technologies and Practices (GTP) survey, to collect data on jobs associated with the use of environmentally friendly production processes. Green technologies and practices are defined by BLS as those that reduce the negative impact on the environment or natural resources resulting from production of any good or service. These technologies and practices include (1) production of green goods and services for use within the establishment, and (2) use of methods, procedures, practices, or technologies that have a positive environmental or natural resources conservation impact. According to the results of this survey, about 854,700 jobs, representing approximately 0.7 per cent of total U.S. employment, were held by workers who spent more than half of their time involved in green technologies and practices in August 2011.[14]

---

[12] Comprehensive information about the BLS approach to the measurement of green jobs can be found on the BLS Website: http://www.bls.gov/green/

[13] http://www.bls.gov/news.release/pdf/ggqcew.pdf

[14] http://www.bls.gov/news.release/pdf/gtp.pdf

58. It should be noted that it is not possible to combine or compare the results of these two surveys in order to provide an estimate of total employment in green jobs, due to overlap between the two populations identified and the conceptual and methodological differences between the two approaches. One particularly valuable aspect of this two-pronged approach used by BLS is that it also allows the provision of detailed information about the occupations, kinds of economic activity, and the kinds of green goods, services, technologies and processes associated with green jobs.

5 Proposed operational definitions of concepts for the statistical measurement of green jobs

59. Compared to definitions suitable for policy purposes, a definition of green jobs for statistical purposes needs to be formulated with sufficient precision to guide the development of operationally viable methodologies for the consistent production of statistics. Moreover, in order to provide statistics that will adequately inform environmental policies as well as labour market, social and economic policies, it is necessary to provide information independently about both the environmental and decent work dimensions. ILO is proposing, therefore, to develop statistical standards that will facilitate the production of datasets that include separate statistics on both 'employment in environmental activities' and relevant decent work indicators. This implies the need for separate definitions pertaining to employment in environmental activities and to decent work.

60. We propose to define the environmental dimension with reference to environmental activities as specified in the most recent System Environmental-Economic Accounting (SEEA)[15], adopted by the UN Statistical Commission. The decent work dimension may be measured according to relevant indicators selected from the ILO manual on Decent Work Indicators currently under development.

61. The SEEA definition of environmental activities covers a similar range of activities to those covered in the ILO Green Jobs Programme definition, but provides specific guidance on those activities that are to be included or excluded. This approach ensures that the determination of those activities that are environmentally beneficial (or green) is the responsibility of the group of experts in environmental accounts who maintain the SEEA, whilst the measurement of employment, jobs and decent work remains the responsibility of the ILO and its constituents. It also facilitates coherence between statistics on green jobs, environmental production and expenditure, and decent work.

62. While the SEEA Central Framework provides a measurement framework for the development of integrated national accounts for the environment, and defines and describes those activities to be counted as environmental activities, it does not provide guidelines on the measurement of employment in these activities

Units of observation and analysis

63. Two basic units of analysis, the job and the person, are relevant to the measurement of green jobs, depending on the objective and measure pursued. Whilst data are likely to be most frequently provided by establishments and households, the usual

[15] The SEEA is a system for organizing statistical data for the derivation of coherent indicators and descriptive statistics to monitor the interactions between the economy and the environment and the state of the environment to better inform decision-making. [15] SEEA contains the internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and its relationship with the economy. See: *http://unstats.un.org/unsd/statcom/doc12/2012-8-EnvAccounting-E.pdf*

.

unit of analysis for green jobs statistics is the job. The job is defined with reference to the latest relevant resolution of the International Conference of Labour Statisticians (ICLS), for example on statistics of employment and work, occupation or working time. According to the most recent draft of 19th ICLS resolution concerning statistics of work and of the labour force a job is defined 'a set of tasks and duties performed, or meant to be performed by one person for a single economic unit'.

64. A job can be formal or informal and can refer to work in employment or in other forms of work, such as volunteer work, trainee work, or production of goods and services for own consumption. Most statistics on green jobs will relate to employment, which refers to activities carried out by persons to produce goods or services mainly to generate income. The conceptual model for statistics on green jobs also allows for the production of green jobs statistics for other forms of work. The occurrence of multiple job holding exists within employment, and also in other forms of work. When statistics on green jobs are tabulated with reference to persons they need, therefore, to refer to one or more jobs held by the person.

65. Where the objectives of the statistics include measurement of how the economy is changing, how establishments re-structure their organization and production processes, and which technologies are used to reduce environmental impact of the production, the most appropriate unit of observation and analysis is the establishment.

Environmental activities

66. The System of Environmental-Economic Accounting Central Framework, adopted by the UN Statistical Commission at its 43rd session in 2012, defines environmental activities as *those economic activities whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources.* These various activities are grouped into two broad types of environmental activity – *environmental protection* activities and *resource management* activities.

67. *Environmental protection* activities are defined in the SEEA as those activities whose primary purpose is the prevention, reduction and elimination of pollution and other forms of degradation of the environment. These activities include, but are not limited to, the prevention, reduction or treatment of waste and wastewater; the prevention, reduction or elimination of air emissions; the treatment and disposal of contaminated soil and groundwater; the prevention or reduction of noise and vibration levels; the protection of biodiversity and landscapes, including their ecological functions; monitoring of the quality of the natural environment (air, water, soil, groundwater); research and development on environmental protection; and the general administration, training and teaching activities oriented towards environmental protection.

68. *Resource management* activities are defined as those activities whose primary purpose is preserving and maintaining the stock of natural resources and hence safeguarding against depletion. These activities include, but are not limited to, reducing the withdrawals of natural resources (including through the recovery, reuse, recycling, and substitution of natural resources); restoring natural resource

stocks (increases or recharges of natural resource stocks); the general management of natural resources (including monitoring, control, surveillance and data collection); and the production of goods and services used to manage or conserve natural resources.

69. The Classification of Environmental Activities (CEA) included in Annex 1 of the SEEA provides detailed descriptions and specifications of those activities to be counted as environmental activities and provides advice on those activities not to be included where there are borderline issues.

Producers of environmental goods and services

70. The Environmental Goods and Services Sector (EGSS) is defined within the SEEA as consisting of producers of all environmental goods and services. Thus, all products that are produced, designed, and manufactured for the purposes of environmental protection and resource management are within scope of the EGSS. The types of environmental goods and services in scope of the EGSS are environmental specific services, environmental sole-purpose products, adapted goods, and environmental technologies

    a) Environmental specific services comprise environmental protection and resource management specific services produced by economic units for sale or own-use. Examples of environmental specific services are waste and wastewater management and treatment services, and energy and water saving activities.

    b) Environmental sole-purpose products are goods (durable or non-durable goods) or services whose use directly serves an environmental protection or resource management purpose and that have no use except for environmental protection or resource management. Examples of these products include catalytic converters, septic tanks (including maintenance services), and the installation of renewable energy production technologies (e.g. installation of solar panels).

    c) Adapted goods are goods that have been specifically modified to be more "environmentally friendly" or "cleaner" and whose use is therefore beneficial for environmental protection or resource management.

    d) Environmental technologies are technical processes, installations and equipment (goods), and methods or knowledge (services) whose technical nature or purpose is environmental protection or resource management. Environmental technologies can be classified as either:

        - End-of-pipe (pollution treatment) technologies
        - Integrated (pollution prevention) technologies

Employment in Environmental activities

71. It is proposed to define employment in environmental activities as follows:

> "Employment in environmental activities comprises all employment in activities that lead to the production of environmental goods and services for consumption by other economic units or for consumption by the establishment in which the activity is performed. Environmental goods and services are the products of environmental activities as defined in the most recently updated

version of the System of Environmental-Economic Accounting (SEEA). In addition to activities in the production of environmental goods and services, this includes activities that improve the establishment's processes in order to reduce or eliminate pressures on the environment or to make more efficient use of natural resources."

72. This definition includes jobs held by persons, during a given reference period, in a green establishment, irrespective of whether it was their main or a secondary job. It includes managers, professionals, technicians, trades and other workers with specific environmental skills, as well as clerical, services, and sales workers plant and machine operators and elementary workers who work in these EGSS establishments.

73. Employment in environmental activities is made up of two components:

    (a) Employment in production of environmental outputs and
    (b) Employment in environmental processes.

74. *Employment in production of environmental outputs* is defined as employment in the production of environmental goods and services for consumption outside the producing unit.

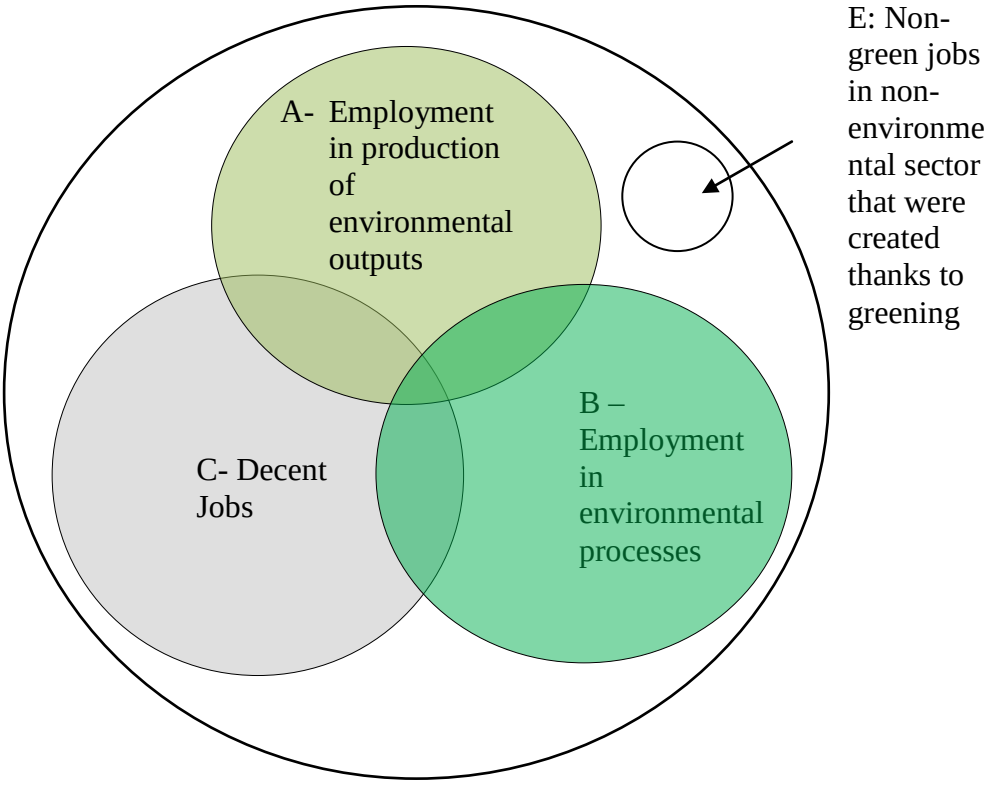
75. *Employment in environmental processes* is defined as employment in the production of environmental goods and services for consumption by the producing unit It consists of all jobs, carried out in EGSS on non-EGSS establishments, or as all persons *engaged in green or greening production process*[16] during a given reference period. These are jobs in which workers' duties involve making their establishment's production processes more environmentally friendly by, for example reducing pollution or using fewer natural resources. These workers research, develop, maintain, or use technologies and practices to reduce the environmental impact of their establishment, or train the establishment's workers or contractors in these technologies and practices. This definition includes workers within establishments that may not be considered as environmental.

76. These two components refer to different aspects of the 'greening' of employment. Employment in production of environmental outputs does not cover employment within establishments that do not produce green outputs but do use green technologies and processes. Employment in environmental processes may nevertheless be found in traditional polluting industries (say mining or steel production) providing that they are increasing their energy efficiency through new models of organization or if they employ green technologies in their production processes. For example, employment in environmental processes would cover not only employment in companies and institutions that physically produce renewable energy but also employment in companies and institutions that focus on energy saving activities

77. According to these definitions of employment in environmental outputs and employment in environmental processes and the concept of decent work, all jobs could be classified according to various categories of green, as shown on the

[16] A list of green processes/technologies may need to be developed.

following diagram, which also covers a number of additional dimensions of "green jobs".



78. Based on these categories, policy makers can derive various groupings depending on the decision of what they want to measure, so that:

- Employment in Environmental activities= $A \cup B$
- Employment thanks to greening = $A \cup B \cup E$
- Employment in Environmental activities that is decent= $(A \cup B) \cap C$

79. Each of these groups may require different measurement strategies. In Chapter 6 we propose methodologies for estimating A and B.

6 Measurement issues and methods

80. Employment in the production of environmental outputs and employment in environmental processes are two distinct concepts that complement each other. Both concepts are useful for analytical and policy-making purposes, as they refer to different aspects of the 'greening' of employment and to different targets for policy-making.

81. The concept of employment in the production of environmental outputs is linked to certain establishment-related characteristics, while the concept of employment in environmental processes is linked to certain job-related characteristics such as skills and tasks.

Employment in production of environmental outputs

82. For the purposes of measuring employment in production of environmental output, the environmental *sector* is defined as consisting of those establishments where all or at least some of the goods or services produced belong to the environmental goods and services domain. Employment in production of environmental outputs is not, however, equal to total employment in the establishments producing environmental goods and services. Many producers of environmental goods and services will also produce a range of other goods and services. Employment in the production of environmental goods and services may, therefore, only be a relatively small component of their total employment. Consequently, employment in production of environmental outputs can be measured directly only in establishments whose output is 100% environmental. In establishments where the production of environmental goods and services constitutes only a secondary activity of an establishment, or where, if it is a principal activity, it is combined with secondary activities in the same establishment estimation will be required.

83. The main reason why employment in production of environmental outputs cannot be measured directly is the absence of information on employment associated with the production at the product code level. Where direct estimates of employment in the production of environmental goods and services cannot be obtained, it can nevertheless be estimated using the data on output (sales) for environmental goods and services. It is necessary first to calculate the value of environmental goods and services produced as a proportion of the value of the total production of the establishment.[17] The same proportion can then be applied to total employment in the establishment in order to estimate employment in production of environmental outputs. Thus if 100% of an establishment's outputs are environmental goods and

[17]In the event that data on environmental output are not available at individual enterprise level, the ratios at industry level may be applied. However, using industry level data instead of products may over estimate or underestimate the size of the green economy if enterprises within industry produce a mix of green and non-green products and services. Expert advice could also be used, particularly for industries where the relationship between patterns of employment and the output of environmental goods and services may vary considerably from the average.

services, 100% of employment in the establishment is included. If 50% of the output is environmental then 50% of employment is included. Whilst this method of measurement does not deal with situations where production of particular types of goods and services might be more or less labour intensive than others, it ensures that the labour inputs of workers in areas such as administration, accounts, information technology, cleaning services and so forth, who contribute indirectly to environmental production, are also counted.

84. For establishments that do not generate revenue (e.g. non-profit organizations, government agencies, research organizations, and new businesses that provide environmental goods and services without generating income), information about the proportion of their employment involved contributing to the production of environmental goods and services may need to be collected.

85. Household units may also undertake many environmental protection and resource management activities. Where production is undertaken for sale, or where the work is performed by employees of the household, these units can be treated in the same way as any other production unit. Where the production is undertaken by members of the household for the benefit of the household, the labour inputs would be considered as 'own-production work' according to the framework for work statistics proposed in the draft Resolution on Labour Force and Work Statistics that will be considered at a Tripartite Meeting of Experts in Labour Statistics early in 2013. Whilst the latter could be considered as work in environmental processes it would not be counted as employment.

86. In practice, however, 'own-production work' in environmental protection and resource management activities may be difficult to measure. It may, nevertheless, be of interest and of some significance in cases where households are commonly engaged, for example, in environmental remediation activities. This could be particularly important in countries where large numbers of households are primarily engaged in agricultural production for own consumption.

87. Adding up the imputed or estimated employment levels at the establishment level, yields total employment in the production of environmental outputs**.**

Identification of industries producing environmental goods and services

88. A key step in the process of identifying green jobs in the environmental sector is the identification of industries producing environmental goods and services.

89. The environmental sector itself is highly diverse. It includes activities carried out by a wide range of establishments in many different economic sectors, from manufacturing enterprises to consultancy firms, from public administration to educational institutions. For example, companies producing environmental equipment are part of manufacturers of machinery and the producers of renewable energy are part of the energy supply sector. It is not recognised by standard statistical nomenclatures as a distinctive sector as is, for example, the iron and steel industry. Therefore a complete and comprehensive list of establishments producing environmental goods and services cannot be established *a priori* using standard statistical classifications like ISIC.

90. Some producers are, nevertheless quite easily identified by ISIC codes. Examples of typical ISIC classes that are *entirely environmental* ' are waste collection, treatment and disposal activities, materials recovery' and 'remediation activities and other waste management' such as sewage and refuse disposal services or recycling. Other producers of environmental goods and services could be identified using relevant information that may be available from other sources of information, e.g. economic censuses. Data classified according to the Central Product Classification (CPC) or other classifications of technologies and products may be useful for this purpose. However, most of the producers of environmental goods and services are very difficult to identify separately because their main activity is not the production of environmental goods and services.[18] In general, it would be necessary to conduct specially adapted establishment surveys/or censuses, in order to identify all such production.

91. The recent revision of the SEEA and its Classification of Environmental Activities (CEA) can help with the identification and grouping of these industries/producers. The CEA is a functional classification used to classify environmental activities, environmental products, and environmental expenditures and other transactions. It covers the two types of environmental activities (environmental protection and resource management). The broad structure of the CEA is presented below:

Classification of Environmental Activities - Overview of groups and classes[19]

I: Environmental Protection (EP)

1 Protection of ambient air and climate
2 Waste water management
3 Waste management
4 Protection and remediation of soil, groundwater and surface water
5 Noise and vibration abatement (excluding workplace protection)
6 Protection of biodiversity and landscapes
7 Protection against radiation (excluding external safety)
8 Research and development for environmental protection
9 Other environmental protection activities

II: Resource Management (RM)

10 Management of mineral and energy resources
11 Management of timber resources
12 Management of aquatic resources
13 Management of other biological resources (excl. timber and aquatic resources)
14 Management of water resources
15 Research and development activities for resource management
16 Other resource management activities

[18] Evidence suggests that environmental goods and services are being produced in wide range of industries as a secondary or ancillary activity

[19] Detailed classes and definitions for activities can be consulted at http://unstats.un.org/unsd/envaccounting/White_cover.pdf

92. Once identification has been made, various surveys can be used to either estimate a direct count of green employees or to estimate it through the revenue received from environmental goods and services. Depending on the level of reliability, the employment data could be then be regrouped by ISIC code and also classified by environmental domains.

Producers outside the scope of environmental sectors[20]

93. For statistical purposes, producers that provide components of an environmental technology or product to the main producer when these components are not to be used exclusively in environmental technologies should be excluded. Also excluded are the activities that involve selling goods already produced (the distributors of the final good). This means that the suppliers of non-exclusively environmental components and the distributors of environmental technologies and products are not part of the environmental goods and services sector.

94. According to many studies, however, these indirect and induced jobs created in the transition to the low carbon economy are extremely relevant for policy makers in terms of employment creation and skills needs. Employment in these groups will increase as economies go green. Expanded green production will lead to a higher demand for input, resulting in an increase in indirect jobs in supplier industries[21]. It is therefore important to find a way to estimate these jobs (i.e. steel workers producing steel for windmills – Group E in Figure 1). As tracking the whole economy's value chain may be a very complex task, quantitative modelling could be a solution for measuring the indirect and induced effects.

Employment in environmental processes

95. The second component, employment in environmental processes, can be measured by asking establishments to provide information on the number of workers employed in activities leading to the production of environmental goods and services for consumption *within* the establishment. This is more difficult to measure and requires types of questions that are not routinely included in economic censuses and surveys aimed at measuring economic production. In view of the potential increase in respondent burden, information on this component is likely to be collected less frequently than information on employment in the production of environmental outputs.

96. Measurement of employment in environmental processes requires collection of data related to job-related characteristics such as occupation, the specific tasks and duties undertaken in the jobs, and the kinds of processes or technologies used.

97. Unfortunately the occupation on its own is not sufficient to accommodate requirements for measuring employment in environmental processes. Whilst a small number of workers employed in occupations such as environmental engineer, or

[20] Non-green jobs in non-environmental sector created thanks to greening (category E in the diagram at the end of chapter 5)

[21] The increased consumer spending of those in these newly created direct and indirect jobs will also create a number of induced jobs.

refuse sorter, may quite easily identified because their occupation is *entirely environmental,* the majority of workers have occupations that involve both environmental and non-environmental activities. Some of the tasks and duties are divided in such a way that some of the duties and tasks are undertaken with environmental process and technologies and the rest of the work is involves non-environmental processes and technologies. For example a researcher working as a private consultant may provide services related to both environmental issues and non-environmental issues.

98. An additional problem is that many workers are involved in production of environmental goods and services for consumption both within and outside the establishment. In order to measure only the part that is related to production of environmental goods and services for consumption within the establishment, it is necessary to split the hours spent on each component in order to model out the number of full-time jobs. An alternative would be to measure employment in environmental processes regardless of the intended consumption.

99. Since the measurement of employment in environmental output and of **e**mployment in environmental processes requires different methods, separate statistics should be produced for each component. The two components cannot**,** however, be aggregated as this would double count workers producing goods or services for consumption within the establishment, when the establishment also produces environmental goods or services for external consumption.

100. A combined total for employment in environmental activities can be provided for both components when the necessary information is available for the same establishment. For example if 100% of total output is environmental, then 0% of employment in environmental processes is counted in the combined total. If there are no environmental outputs, but 10% of employment is in internal environmental activities, then all of the 10% is included in the combined total. If 70% of an establishment's outputs are environmental goods and services and 30% of workers are involved in environmental processes, in order to avoid double counting it is necessary to estimate the part of these 30 % engaged in environmental processes for internal consumption.

7 Data collection

101. Data collection is, of course, an integral and essential part of developing and updating statistics on green jobs. Formal data collection activities should be established, adapted to countries' national circumstances, and reviewed periodically. In most cases the capacity and willingness of agencies to conduct new surveys will be limited by the resources available and the priorities given to policy needs for various statistics.

102. The main sources of information that may be used to assess how many green jobs exist in specific sectors are surveys and censuses of establishments. To optimize resource use it is suggested that, as far as possible, the required data be collected by extending existing surveys rather than by initiating totally new ones. The possibility of incorporating new questions or modules in existing, ongoing or planned surveys should be therefore be explored in order to fill the data gaps.

103. Depending on national priorities, data collection could be focused on key economic activities and industries, for example the largest in terms of their contribution to the production of environmental goods and services, and/or on those that have the greatest potential to change. Surveys can be limited to some producers and not to the entire population of the EGSS. A pragmatic approach could be to focus on some resource management subsectors (renewable energy, organic agriculture, ecotourism or sustainable forestry), where clear benchmarks exist (e.g. specific labels).

104. Respondent burden may be minimized by the inclusion in questionnaires of filtering questions that identify possible in-scope respondents, so that only those establishments that indicate they produce at least one of the selected environmental goods or services would be asked detailed questions on environmental activities.

105. In order to estimate employment in the production of environmental output the questionnaire should include, at a minimum, questions on the types of environmental goods and services produced in the establishments surveyed, the value of, or sales revenues from, these goods and services and the number of persons employed in the establishment.

106. Information that would allow estimation of employment by each type of environmental output, could be obtained by asking respondents in establishments to indicate whether the production of environmental goods or services is their principal or secondary activity, and to provide a list of the environmental goods and services produced indicating the percentage of total turnover associated with each environmental good or service. Respondents could be assisted in identifying environmental goods and services

107. Data collected in this way will include turnover by type of environmental output. For establishments that report that their outputs are entirely environmental, 100% of employment in the establishment will be counted as employment in environmental activities. For establishments that undertake both environmental and non-environmental activities, the environmental outputs will be able to be isolated, thereby facilitating allocation of an appropriate proportion of total employment in the establishment to employment in environmental activities.

108. In surveys that aim to collect data on both employment in the production of environmental output and in environmental processes, the questionnaire could include questions on share environmental turnover in total turnover and questions that would allow determination of the proportion of employees who are directly involved in the production/provision of environmental technologies, goods and services or who carry out environment-related activities. To avoid double counting a distinction should be made between the time spent on environmental activities for consumption within and outside the establishment,

109. In surveys that collect data on employment in environmental processes, but do not collect information on environmental outputs, the questionnaire should include questions on the types of technologies used and the number of employees who are directly involved in technologies that reduce the environmental impact of their establishment. Where possible a distinction should be made between those that spend less than 50% and those that spend more than 50% of their time on environmental activities. If the establishment uses environmental technologies for its own consumption and also for consumption by other units, the volume of employment should be split, if possible, in proportion to the values of internal and external consumption.

Surveying the agricultural and informal sectors

110. The collection of statistics on green jobs constitutes a particular challenge in countries with large informal sectors, and/or where agriculture, forestry and fishing are important. Traditional establishment surveys based on business registers are unlikely to be the best option, as these sectors are not normally covered or up-to-date in registers. More useful potential sources include household surveys, agricultural censuses and area-based establishment surveys designed specifically to collect data from small or unregistered economic units, including those in agriculture and the informal sector. In those countries that carry out agricultural censuses, estimates of employment on organic farms, for example, could be made on the basis of the surface areas under organic production, the production of organic products, or the income generated from sales of organic products. Interviews with experts in certain sectors could also be used to some extent especially to assist in design of surveys. There is little or no empirical evidence or documentation of national experience, however, on the use of such sources to collect information on employment in environmental activities in these sectors.

111. In some countries data on employment in environmental output in agriculture could be collected by including questions in the existing labour force, agricultural or other area-based surveys on, for example, the use of fertilizers and pesticides in agricultural production.

112. Compiling information on employment in environmental output in the non-agricultural informal economy may be more difficult because respondents and interviewers may have difficulty in assessing the extent to which the activities performed or products produced fall within scope of the EGSS. Therefore questions may focus only on selected sectors like such as waste collection and ecotourism where clear benchmarks exist (e.g. specific labels) or are by nature 100% environmental.

113. In an ILO study undertaken in Bangladesh[22], *core environment-related jobs* were identified based on the environmental performance of the sector or activity measured against standards, benchmarks, codes, and compliance with regulations (where possible). These jobs were estimated by means of literature review, interviews with experts, sector specific studies and investment to job ratios within individual sectors. These core environment-related jobs formed the basis for subsequent analysis. To assess the decent work aspect, they were screened to determine whether they provided acceptable working conditions. Data on decent work indicators were gathered from published sources and stakeholder interviews. It should be noted, however, that the quality of the information for decent work differed by type of environment related activity or sector. Overall this study was not reliable enough to provide an estimate of the share of green jobs, of the standard normally required for official statistics.

Inventories of producers of environmental goods and services;

114. The use of inventories of establishments that produce environmental goods and services, if they are kept up-to-date consistently over a prolonged period, is a simple and effective way and of assessing how many green jobs exist in specific sectors or regions.

115. Such inventories should contain data on the establishments that produce environmental goods and services, and if possible, on those employing environmental processes. They may also contain lists of environmental goods and services and technologies. For this purpose, it may be useful to establish standardized lists of environmental goods, services and technologies, based on the SEEA. These lists could not remain constant over time and would need to be updated regularly to take account of the development of new products, services and technologies. Lists of establishments would need to be updated on a regular basis for the same reason.

116. Business registers may contain the information required, but keeping this information up-to-date is not an easy process. Industry and business associations that bring together businesses working in a common field, or using similar technologies can often be a useful source of information. As specialists in their field they will have an insider's knowledge of the most common processes used, and may even be willing to survey their members at regular intervals to assess penetration of new processes, goods and services. Patent registers and registers of recipients of clean-tech venture capital may also provide some information, at least on formal sector establishments engaged in environmental activities.

Modelling

117. In situations where the data are incomplete, input-output (I-O) analysis and Social Accounting Matrices (SAMs) and other Computable General Equilibrium (CGE) and related complex models may need to be used in order to estimate employment.

[22] http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_159433.pdf

Input-output (I-O) analysis and Social Accounting Matrices (SAMs) are empirical tools that rely on the construction of a matrix or table listing all subsectors in an economy and detailing how outputs from one sector are used as inputs to others. These models draw on information from the national accounts.

118. The basic input-output model measures how much additional output is needed from each sector to meet an increase in final demand. If information on the labour intensity of the different sectors in an economy can be obtained, then the matrix can be used to estimate the effect on employment of an increase in demand for a green service or product. Thus, these models can be used to answer questions such as "How many jobs might result from a given program of investment in sustainable economic areas?" or "For a given level of investment, which sector or sectors would yield the greatest number of jobs?" I-O models and SAMs are usually used to provide short to medium term projections for policies.[23] The Computable General Equilibrium models take the work of input-output analysis and SAMs a step further by simulating full economy responses to exogenous changes. Typically they combine empirical data with a series of economic equations designed to comprehensively capture the dynamism and complexity of an entire economy. In this way, they can explore the effects of policies over time on a variety of different macroeconomic parameters, including future employment scenarios. These models allow policy-makers the opportunity to calculate the long-term impacts of policies.

[23] ILO, Methodologies for assessing Green Jobs, Policy Brief

8 Types of data to be collected, statistical measures and indicators to be produced

119. The transition towards a green economy implies a progressive increase in the share of green production and green employment in the economy. In order to assess, whether and how far the green transformation has progressed, information needs collected and analysed in consistent manner on various aspects of the activities of institutions in the economy both within and outside the EGSS.. This includes information on employment, production, value added, exports, imports, innovation, research and development and fiscal schemes and subsidies. Progress can be assessed using indicators such as the share of these sectors in total output; share of green investment in total investment; and share of green jobs in total employment.

120. As we discussed in Chapter 3 there is a need, however, not only for indicators of progress in general, but also for statistical measures that will inform the development of public policy in a wide range of areas. The discussion of potential indicators presented below is proposed as a starting point to promote discussion of the indicators and measures that will be most useful rather than as a final list. These measures will need to be further elaborated as new data become available and as concepts and ideas evolve. They reflect our preliminary thinking.

Employment in environmental activities

121. Employment in environmental activities (total and by economic activity) expressed in absolute numbers and as a percentage of total employment is a potential headline indicator of progress towards a green economy. Separate data for employment in production of environmental outputs and for employment in environmental processes would also be of interest. Although the whole economy needs to be involved in the green transformation, there is nonetheless a need to focus on the core of key green industries that characterise a green economy. Their progress should be closely monitored and disaggregation of data by economic activity will facilitate both identification of core industries and monitoring of progress in other industries.

Employment by occupation

122. Full description of employment in the environmental goods and services sector and assessment of skill requirements for its employees will require relatively detailed data classified by occupation. This will provide information about the skill levels, levels of education and specialized skills required. Analysing the education and skill levels required for green jobs will also assist in gaining and understanding of development of the environmental goods and services sector could provide jobs for those with lower levels of education and those that are unemployed. Levels of education among workers could also be used as an indicator of the level of knowledge content within an economic sector. It could potentially be considered as an indicator of the development potential of the EGSS

Employment by environmental domain

123. Breaking down employment and turnover (or output) data by the environmental domains specified in the SEEA wil allow identification of the types of

environmental initiatives that are likely to lead to the creation of more jobs, and to assess relative levels of labour productivity .

Employment by sex

124. A complementary analysis disaggregated by sex is essential to allow understanding the gender patterns of the environmental goods and services sector employment, and the differential impact on males and females of particular environmental initiatives

Employment by type of green technology used (total and by economic activity)

125. Statistics on the employment impacts of how companies re-structure their organisation and production processes and of the technologies that are used to reduce environmental impact of the production will provide important inputs to labour market planning, and understanding of which technologies are likely to create employment opportunities.. Disaggregation by economic activity can be used to evaluate how local labour markets are making the transition to greener activities.

Percentage of establishments using green technologies

126. Statistics on the percentage of establishments using green technologies (total and by economic activity) would allow assessment of the general progress made towards a greener economy.

Wages and hours of work:

127. While collecting data on employment in the environmental goods and services sector, it could be interesting and useful, to collect also data on wages and hours of work.. This would improve analysis on the EGSS with some further insight on the quality of the employment in the sector.

APPENDIX I: Existing concepts and definitions related to the green economy

Sustainable development

United Nations Brundtland Report (1987)

The United Nations Brundtland Report (1987) included what is now one of the most widely recognised definitions: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [1]

According to the same report, the above definition contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. [8]

Green growth

OECD (2011) (http://www.oecd.org/dataoecd/37/33/48224574.pdf)

Green growth is about fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities. (OECD. 2011. Towards Green Growth: Monitoring Progress OECD Indicators)

ESCAP (United Nations Economic and Social Commission for Asia and the Pacific) (http://www.greengrowth.org)

Green growth is environmentally-sustainable economic progress that fosters low-carbon, socially inclusive development. It articulates concise and clear entry points and policy approaches for making real gains in eco-efficiency and transferring to low-carbon development: synergizing climate action with development goals. Green Growth comprises six, mutually-reinforcing "Paths", or entry points, through which policy makers can focus interventions: Sustainable Consumption and Production (SCP), Greening Business and the Markets (GBM), Sustainable Infrastructure (SI), Green Tax and Budget Reform (GTBR), Investment in Natural Capital (INC), and Eco-efficiency Indicators (EEI).

Green economy

Various agencies of the United Nations system have identified green economy as "investment in sectors such as energy efficiency technologies, renewable energy, public transport, sustainable agriculture, environment friendly tourism and sustainable management of natural resources, including ecosystems and biodiversity" aimed at

generating new areas of production, quality jobs and an increase in income, while serving to mitigate climate change and protect biodiversity (United Nations).

UNEP (2011)

(http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_synthesis_en.pdf)

The United Nations Environment Programme (UNEP) defines a green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive. In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. These investments need to be catalysed and supported by targeted public expenditure, policy reforms and regulation changes. The development path should maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and as a source of public benefits, especially for poor people whose livelihoods and security depend on nature. (UNEP. 2011. Towards a Green Economy – Pathways to Sustainable…)

XVII Meeting of the Forum of Ministers of Environment of Latin America and the Caribbean – held in Panama City, Panama, from 26 to 30 April 2010

This meeting defined a Green Economy as a system of economic activities related to the production, distribution and consumption of goods and services that results in improved human well-being over the long term, whilst not exposing future generations to significant environmental risks and ecological scarcities. It is environmentally friendly and ecological, and for many groups, it is also socially just."

UNCTAD

The United Nations Conference on Trade and Development *(*UNCTAD*)* defines green economy as a productive process resulting from the improvement of human well-being and the reduction of inequalities, while limiting the significant scarcity risks at the environmental level for future generations.

Greening the economy

Greening the economy is a strategy under consideration by countries to enhance the quality of life of their citizens and to pursue sustainable development goals. The transformation of traditional economies into green economies is ***based on making investments in technologies***, systems and infrastructures that enhance productive economic activities while optimizing natural resource utilization and minimizing environmental impacts. The objective is to foster investments supporting social and environmental goals that would act as drivers for, instead of barriers to, sustainable economic growth.

Transition to greener economies

Transition to greener economies implies the *formulation of an overarching integrated approach that links social, economic and environmental* policies and actions designed to ensure sustainable development and poverty eradication. Green growth strategies in developing countries need to be undertaken within this context and should ultimately address major priorities such as: providing basic education, housing and employment; ensuring food security and health coverage; and delivering essential services such as access to modern energy, water, sanitation, waste treatment and transport.

Green industries/ Environmental Goods and Services Sector (EGSS)

Eurostat Handbook (2009) – Based on OECD/Eurostat definition in 1999
(http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-012/EN/KS-RA-09-012-EN.PDF)

The Environmental Goods and Services Sector (EGSS) includes producers of technologies, goods and services that:

1) Measure, control, restore, prevent, treat, minimize, research and sensitize environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes "cleaner" technologies, goods and services that prevent or minimize pollution.
2) Measure, control, restore, prevent, minimize, research and sensitize resource depletion. This results mainly in resource-efficient technologies, good and service that minimize the use of natural resources.

Green industry statistics in the Republic of Korea *(*Lee Jae-Won from Statistics Korea at the UNEP Workshop, Nov 2011, on Measuring "Green…)

The green industries are defined as those industries that produce goods and services that enhance energy- and resource efficiency, reduce greenhouse gases and improve the environment. These are determined on the basis of the green products classification system, for which a concordance table with the classification system of the EGSS has been developed.

Greening of occupations

The US National Center for O*NET Development (2009)
(*http://www.onetcenter.org/dl_files/Green.pdf*) and
(http://www.onetcenter.org/reports/Green.html)

"Greening of the World of Work: Implications for O*NET, SOC and New and Emerging Occupations (2009)."

The 'greening' of occupations refers to the extent to which green economy activities and technologies increase the demand for existing occupations, shape the work and worker requirements needed for occupational performance, or generate unique work and worker requirements."

APPENDIX II: Some country practices in defining green jobs

United States of America[24]

The U.S Bureau of Labor Statistics has developed a framework and methodology for measuring green jobs based on the type of the production (green production or not.

According to this framework, green jobs are either:

A. **Jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources.** These goods and services are sold to customers, and include research and development, installation, and maintenance services. This definition was used in the BLS survey of establishments in industries that produce green goods and services. Green goods and services fall into one or more of five groups:

1. Energy from renewable sources. Electricity, heat, or fuel generated from renewable sources. These energy sources include wind, biomass, geothermal, solar, ocean, hydropower, landfill gas, and municipal solid waste.

2. Energy efficiency. Products and services that improve energy efficiency: Included in this group are energy-efficient equipment, appliances, buildings, and vehicles, as well as products and services that improve the energy efficiency of buildings and the efficiency of energy storage and distribution, such as Smart Grid technologies.

3. Pollution reduction and removal, greenhouse gas reduction, and recycling and reuse. These are products and services that:

    - Reduce or eliminate the creation or release of pollutants or toxic compounds, or remove pollutants or hazardous waste from the environment.

    - Reduce greenhouse gas emissions through methods other than renewable energy generation and energy efficiency, such as electricity generated from nuclear sources.

    - Reduce or eliminate the creation of waste materials; collect, reuse, remanufacture, recycle, or compost waste materials or wastewater.

4. Natural resources conservation. Products and services that conserve natural resources: Included in this group are products and services related to organic

[24] www.bls.gov/green

agriculture and sustainable forestry; land management; soil, water, or wildlife conservation; and storm water management.

5. Environmental compliance, education and training, and public awareness. These are products and services that:
   - Enforce environmental regulations.
   - Provide education and training related to green technologies and practices.
   - Increase public awareness of environmental issues.

B. Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources. These workers research, develop, maintain, or use technologies and practices to lessen the environmental impact of their establishment, or train the establishment's workers or contractors in these technologies and practices. This definition was used in the BLS survey of establishments across all industries to identify jobs related to green technologies and practices used within the establishment. These technologies and practices fall into one or more of four groups:

1. Energy from renewable sources. Generating electricity, heat, or fuel from renewable sources primarily for use within the establishment: These energy sources include wind, biomass, geothermal, solar, ocean, hydropower, landfill gas, and municipal solid waste.
2. Energy efficiency. Using technologies and practices to improve energy efficiency within the establishment: Included in this group is cogeneration (combined heat and power).
3. Pollution reduction and removal, greenhouse gas reduction, and recycling and reuse. Using technologies and practices within the establishment to:
   - Reduce or eliminate the creation or release of pollutants or toxic compounds, or remove pollutants or hazardous waste from the environment.
   - Reduce greenhouse gas emissions through methods other than renewable energy generation and energy efficiency.
   - Reduce or eliminate the creation of waste materials; collect, reuse, remanufacture, recycle, or compost waste materials or wastewater.
4. Natural resources conservation. Using technologies and practices within the establishment to conserve natural resources. Included in this group are technologies and practices related to organic agriculture and sustainable forestry; land management; soil, water, or wildlife conservation; and storm water management.

Netherlands[25]

In the report "Green growth in Netherlands", Statistics Netherlands gives an overview of green growth[26] in the Netherlands. It presents the available data for twenty of the thirty indicators proposed by the OECD in their intermediate report of February 2011. The indicators are grouped into four themes: 1- Environmental efficiency, 2- Natural asset base, 3-Environmental quality of life and 4- Policy response and economic opportunities. The fourth theme includes the indicator on green jobs.

Green jobs are defined as follows:

"Green jobs measure the employment in companies and institutions that produce goods and services that measure, prevent, limit, minimise or correct environmental damage, resource depletion and resource deterioration".

The basis for the environmental goods and services is the environmental purpose i.e. environment protection and resource management. 'Environmental purpose' means that the technology, good or service has been produced for the purpose of:

- Preventing or minimising pollution, degradation or natural resources depletion
- Reducing, eliminating, treating and managing pollution, degradation and natural resources depletion or restoring environmental damage to air, water, waste, noise, biodiversity and landscapes
- Carrying out other activities such as measurement and monitoring, control, research and development, education, training, information and communication related to environmental protection and/or resource management.

The **environmental goods and services sector** consists of a heterogeneous set of producers of technologies, goods and services that:

- Measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes 'cleaner' technologies, goods and services that prevent or minimise pollution.
- Measure, control, restore, prevent, minimise, research and sensitise resource depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources.

Other aspects of green growth, such as greening production processes which may occur in all industries, are described by other indicators. For example production based greenhouse gas intensity, energy efficiency, surplus of nutrients, material intensity, water use intensity and waste treatment under the theme environmental efficiency and fish inputs and threat to biodiversity under the theme natural asset base.

---

[25] ***The Netherlands (2011)*** (http://www.cbs.nl/NR/rdonlyres/65FA4466-853C-4223-8B69-7C7872E37DC3/0/2011p44pub.pdf)

[26] Green growth is defined by the OECD as the realisation of economic growth while the quantity and quality of natural resources remains sufficient to guarantee the current level of welfare. Green growth also means promotion of investments, competition and innovation required for sustainable growth and resulting in new economic opportunities.

Australia and New Zealand[27]

In order to define "Green collar workers", the Environment Institute of Australia and New Zealand looked at data on occupation by industry and identifed three factors that describe a 'green collar worker':

- the skills and responsibilities of the individual,
- the industry and nature of the organisation for which they work, and
- whether the job and the organisation tend towards the environmental or sustainable end of the green spectrum.

Based on these criteria and on analysis of the occupational groups defined in the Australian and New Zealand Stansrd Classification of Occupations, they concluded that:

(i) In the first three ANZSCO groups – Managers, Professionals and Technicians, and Trade Workers, green collar workers are usually defined by their specific skills or responsibilities, though they may also be defined by the nature of their organisation.

(ii) In the last five groups, green collar workers are almost always defined by the nature of organisation they work for.

This lead to two types of green collar workers:

i. Managers, professionals and technicians who work in green organisations or who have green skills and responsibilities within other organisations that may not be considered green.
ii. Services, clerical, sales and semi-skilled workers who work in green organisation

The report, however, does not explicitly specify what constitutes a green organisation..

New Zealand[28]

Green jobs are jobs that produce goods or provide services that benefit the environment or conserve natural resources through the use of sustainable, environmentally friendly, processes and technologies.

27 Who are the Green Collar Workers? Defining and identifying workers in sustainability and the environment, Environment Institute of Australia and New Zealand, 2009

28 How green is my occupation classification (2010) (http://www.victoria.ac.nz/vms/industrial-relations-centre/irc-events/lew-conference-welcome/lew-papers/D5_LEW14_final_paper_-_Hancock.pdf)

Canada[29]

Environmental employment is the performance of employment activities that seek to manage the use of, impact on, and enhance the sustainability of the environment. These activities, which could relate to the governance of environmental activities, the supply of environ-mental products and services, or the development and dissemination of environmental knowledge, may be categorized in any of the following sectors:

a) Environmental protection,

b) Conservation & preservation of natural re-sources, and

c) Environmental sustainability.

Bangladesh[30][31]

"Green jobs" refers to the direct employment which reduces environmental impact ultimately to the levels that are sustainable. This includes jobs that help to reduce the consumption of energy and raw materials, decarbonize the economy, protect and restore ecosystems and biodiversity, and minimize the production of waste and pollution.

Core environment-related employment refers to jobs which are sustained by activities that are more environmentally sustainable (as defined by compliance with relevant standards and other performance indicators in the study process) but which have not been 'filtered' for decency of work.

---

29 ECO Canada. Environmental Statistics. Measuring Green Collar Jobs in British Columbia. (2010) (http://www.docstoc.com/docs/42797176/Measuring-Green-Collar-Jobs-in-British-Columbia---Environmental)

30 ***Green Jobs in Bangladesh (2008)*** (http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/meetingdocument/wcms_099401.pdf)

31 ***Estimating Green Jobs in Bangladesh (2010)*** (*http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_159433.pdf*)

APPENDIX III: Estimates of green employment form selected countries

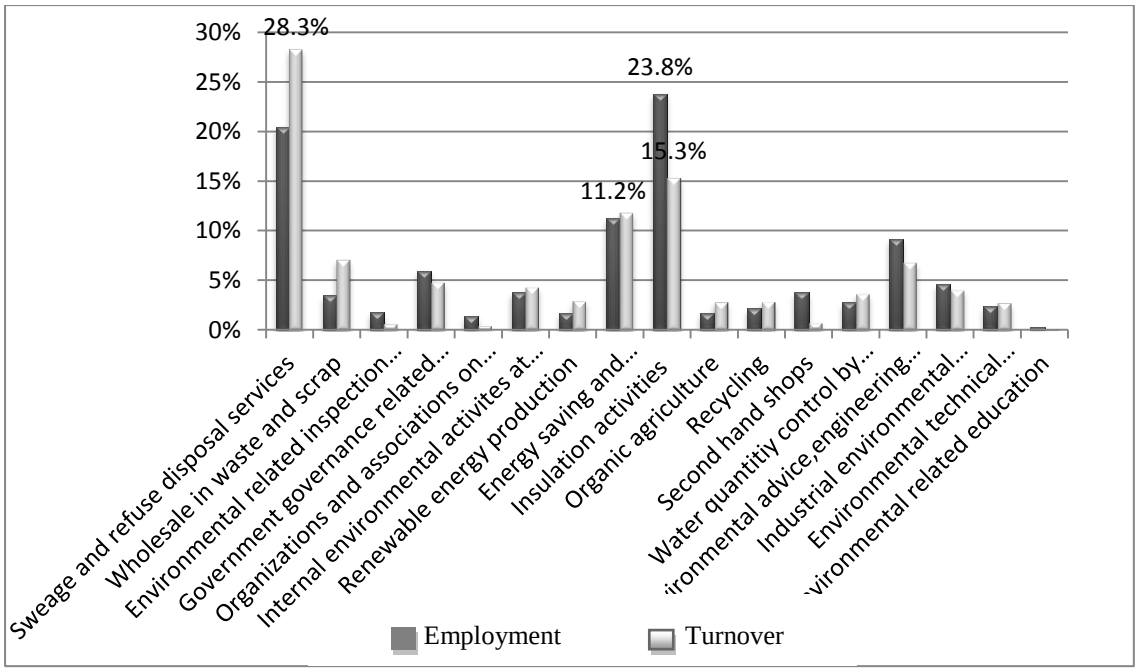
This appendix contains examples of estimates of green employment from selected countries that have carried out studies of the sector (Austria, France, Netherlands, Sweden and USA)

Netherlands

In 2009 the EGSS contributed 13.2 billion Euros to the Dutch GDP and 137,000 full-time equivalents to employment. Total value added equalled 32.4 billion Euros. In 2009 EGSS had a share of 1.6% in total employment in the Netherlands and the contribution to GDP was 2.3 %.

In 2009, the largest share of employment in total EGSS employment belonged to activities related to 'Insulation" (23 % of total EGSS employment) whose contribution to total EGSS turnover was 15 %. Activities related to 'Sewerage and refuse disposal services' were responsible for 28% of total EGSS turnover. Sustainable Energy sector which consist of companies and institutions that have focus on energy saving activities, also played an important role in EGSS with 11% of total EGSS turnover and about 11% of EGSS employment.

Figure 1. Environmental employment and environmental turnover by environmental domain, 2009



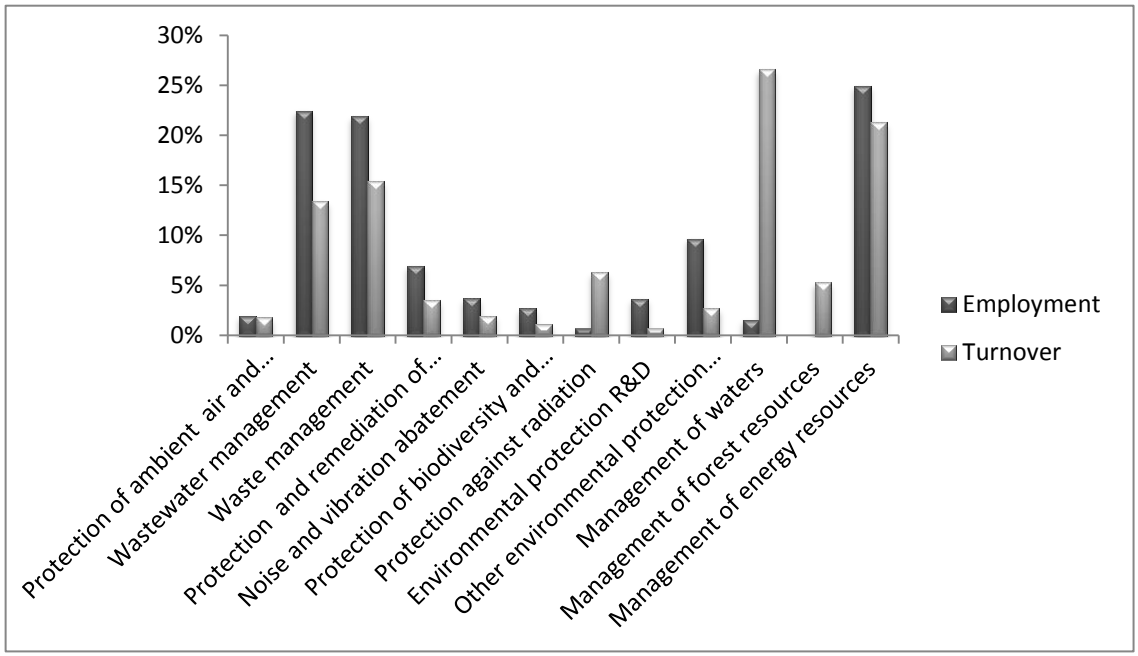
Source: Statistics Netherlands (2012)[32]

[32] Rossum , Maarten van (2012) : Economics indicators for the Dutch Environmental Goods and Services Sector, Time series data for 1995-2009 , CSB Netherlands ,The Hague 2012, National Accounts Department available at

France

EGSS employment increased 2.5 percent over the period of 2007-2009 and EGSS turnover increased 8.4 percent. In 2009 management of energy resources accounted for almost 25% of total employment in EGSS. In terms of turnover, the most important activity was management of water which was responsible for 26.6% of total EGSS turnover.

*Figure 2. Environmental e***mployment and environmental turnover by environmental domain, 2009**



Source: Eurostat [33]

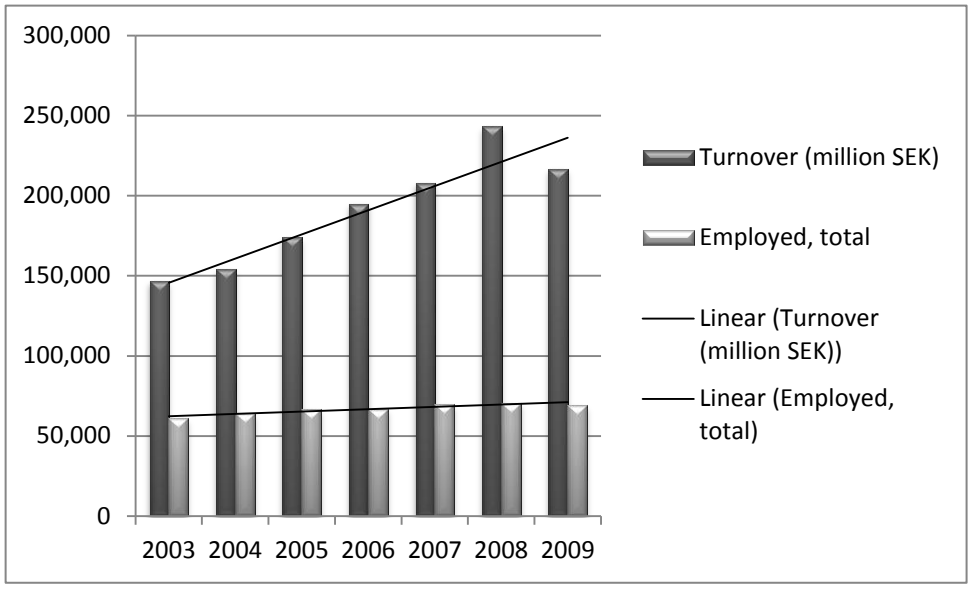
http://www.cbs.nl/NR/rdonlyres/6048B589-C79F-416E-A5E2-BD93E3DCA29C/0/2012EGSSCBSbackground.pdf

[33] http://epp.eurostat.ec.europa.eu/portal/page/portal/environment/data/database

Sweden

From 2003 to 2009 EGSS turnover increased 47.6 per cent while employment increased 13.3 per cent.

Figure 3. EGSS Employment and turnover (2003-2009)



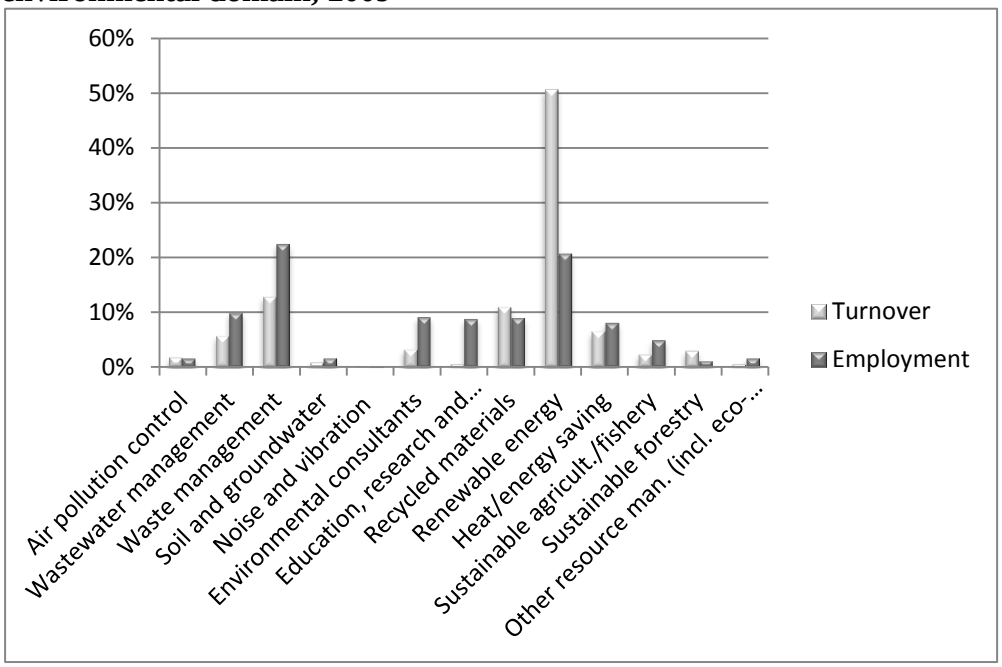
Source: Statistics Sweden[34]

Among all environmental domains, Waste Management in Sweden had the largest number of employees, 15,480 employees out of total 68,972. The second largest environmental domain with almost 21% of employees was Renewable Energy. This sector is responsible for almost 50% of total EGSS turnover.

According to the data about 75 % of the employees were men.

[34] System of Environmental and Economic Accounts database http://www.scb.se/MI1301-EN

Figure 4. Environmental employment and environmental turnover by environmental domain, 2009

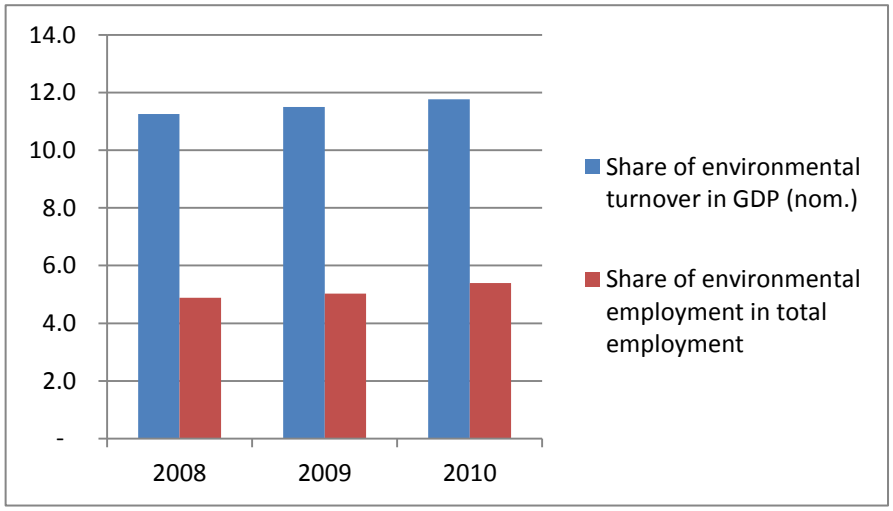


Source: Statistics Sweden[35]

Austria

Employment in EGSS increased 9.6 per cent between 2008 and 2010 grown. In the same period the turnover in the environmental sectors increased 5.8 per cent.

Figure 5. Share of environmental turnover and environmental employment in total turnover and in total employment, 2008-2010



Source: Statistics Austria [36]

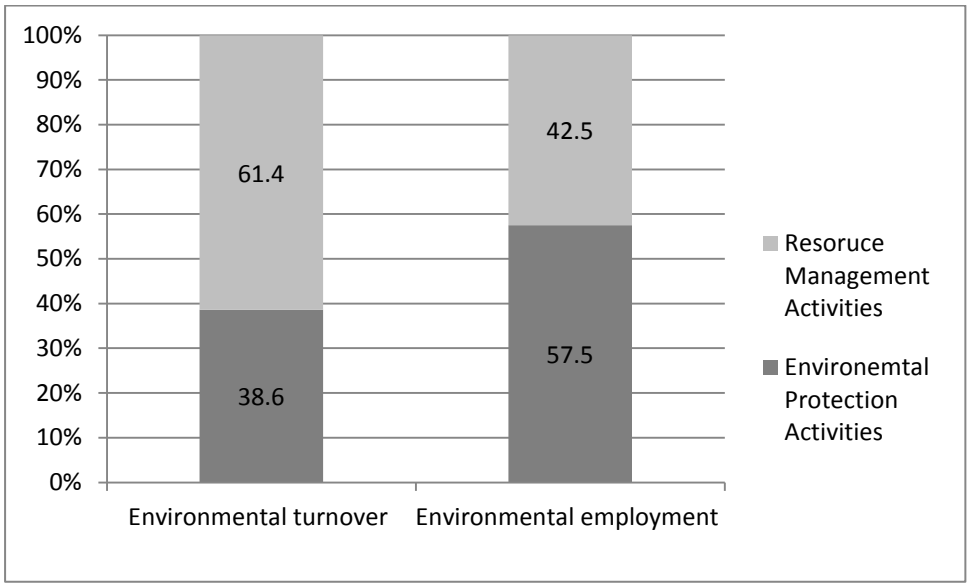
35 System of Environmental and Economic Accounts database http://www.scb.se/MI1301-EN

Figure 6 illustrates the distribution of environmental turnover and employment by two main environmental activity categories: Environmental Protection and Resource Management Activities. The data reveal that environmental protection activities are more labour intensive than resource management ones. Environmental Protection Activities accounted for 57.5% % of total employment in EGSS but contributed to 38.6% of EGSS turnover. Resource Management activities were responsible for over 60 per cent of EGSS turnover and over 40 per cent of employment in EGSS.

In 2010, management of energy resources, including renewable energy, heating and energy saving and also minimization of the intake of fossil resources for uses other than energy production, had the largest contribution to the employment and turnover in EGSS (almost 50% of total turnover and 35 % of total employment). Employment in this environmental domain grew 0.6 per cent between 2008 and 2010 and turnover increased 5.1 per cent in the same period.

The second largest environmental domain, in terms of employment, is 'Protection and remediation of soil, groundwater and surface water 'with 26.4% of total employment. Employment growth in this sector was 38.7 per cent from 2008 to 2010 and environmental turnover growth of 34.1 per cent happened at the same period.

Figure 6. Turnover and employment in Environmental protection activities and Resource management activities (2010)



Source: Statistics Austria[37]

Between 2008 and 2010l turnover and employment in EGSS increased more than increases in GDP and in total employment. Environmental Turnover had increased 5.8

[36] The Environmental Goods and Services Sector (EGSS database http://www.statistik.at/web_en/statistics/energy_environment/environment/eco_industries_environmentally_goods_and_services/index.html

[37] The Environmental Goods and Services Sector (EGSS database http://www.statistik.at/web_en/statistics/energy_environment/environment/eco_industries_environmentally_goods_and_services/index.html

per cent and Environmental employment increased 9.6 per cent; while the increase in GDP was only 1.2 per cent and total employment had a negative growth of 0.7 per cent.

USA

In 2010, Green Goods and Services employment was 3,129,112 (2.4 % of total employment) of which 2,268,824 jobs were in private sector. Government had 860,300 GGS jobs which was about 4% of total public sector employment. Local government was responsible for the major part of GGS jobs in public sector with 476,500 jobs representing 3.4% of total local government employment. Transportation and warehousing sector had the major GGS employment in local government (228,900 GGs jobs).

In 2010 private industry accounted for 2,268,800 GGS jobs. Manufacturing had the largest share in GGS private sector jobs (20%) which are 4% of manufacturing jobs. Construction industry including construction of plants that produce energy from renewable sources and weatherizing and retrofitting projects that reduce household's energy consumption, had 372,100 GGS jobs which is correspond to 6.8% of all jobs in construction. Professional, scientific, and technical services is the 3rd largest private industry which accounted for 349,024 jobs which is 4.7% of this industry's employment. This industry contains engineering and architectural services, computer systems design and management and consulting services.

Administrative and waste services industry which includes waste collection and remediation services, accounted for 319000 jobs, 4.3% of total industry's employment.

Table 1. Green Goods and Services Employment in public and private sector (2010)

	Private and public sector	Private sector
GGS employment	3,129,112	2,268,824
Total employment	127,820,442	106,201,232
GGS share in total	2.45%	2.14%

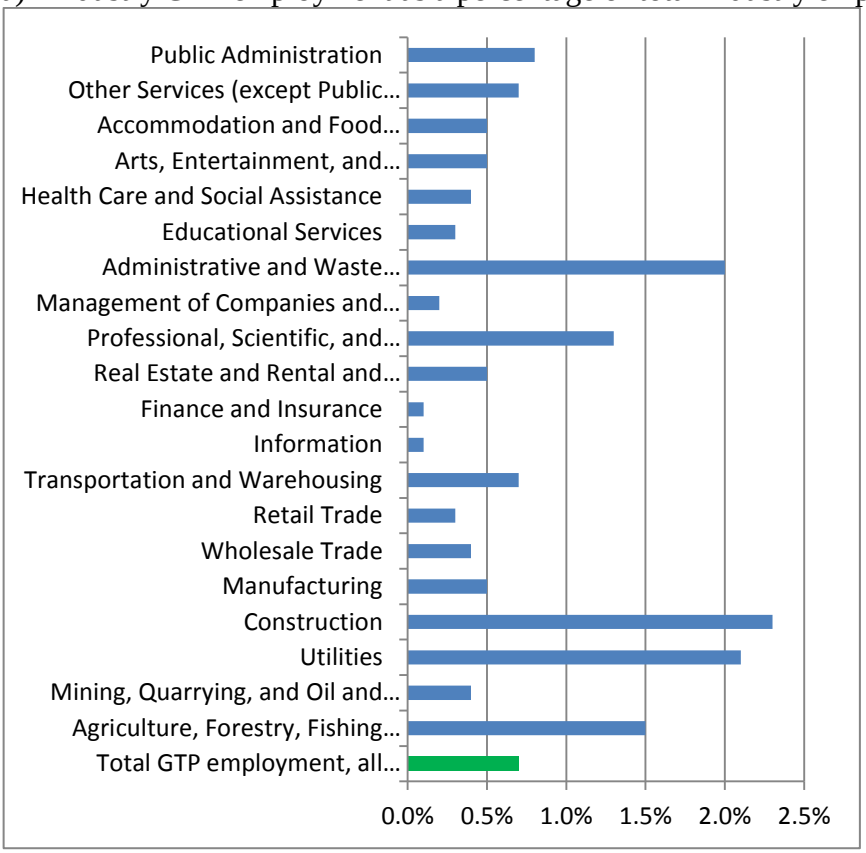
Source: BLS (2012)[38]

According to the US BLS, Green Technologies and Practices survey about 854,700 jobs, representing 0.7 percentage of total U.S. employment, were held by workers who spent more than half of their time involved in green technologies and practices during the survey reference period. The industries with the highest levels of GTP employment included administrative and waste services (151,900) and construction (134,100). GTP employment as a percentage of industry employment ranged from 2.3 per cent in construction to 0.1 per cent in finance and insurance and information. (See table 5.)

Figure 7. Employment for workers spending more than half their time involved in green technologies and practices (GTP employment) by industry, August 2011

[38] Green Goods and Services News Release, http://www.bls.gov/news.release/ggqcew.htm

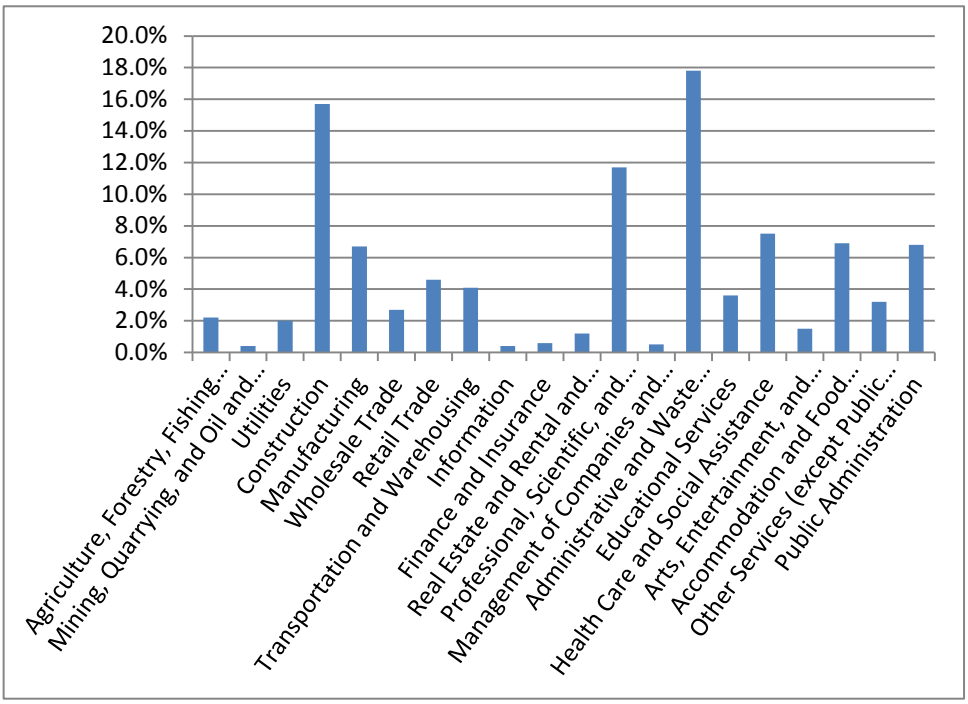
a) Industry GTP employment as a percentage of total industry employment



Source: BLS (2012)[39]

b) Industry GTP employment as a percent of total GTP employment

[39] Green Technologies and Practices (GTP), http://www.bls.gov/gtp/



Source: BLS (2012)[40]

[40] Green Technologies and Practices (GTP), http://www.bls.gov/gtp/